REMARKS

Applicant respectfully requests reconsideration of the instant application on the basis of newly amended independent Claims 1 and 6 and independent Claims 2 and 7. Claims 1 and 6 are the main claims and the remaining claims are directly or indirectly dependent upon those.

The Examiner has rejected the claims as being unpatentable over U.S. Patent No. 6,670,752 by Kinoshita *et al.* (*Kinoshita*) in view of U.S. Patent No. 6,831,341 by Kan *et al.* (*Kan*). It is believed that Claims 1 to 14 are clearly distinguishable over these two references for the reasons that will be set forth.

Support for the amendment of Claims 1 and 6 is found in the specification, paragraphs [Para 39] though [Para 41] and others.

The amendments to Claims 1, 2, and 6, 7 also address the Claim Objections raised on page 2 of the subject Office Action.

35 U.S.C. § 102(b) Grounds for Rejection

The Examiner has principally rejected the claims as being anticipated by *Kinoshita*. It is believed that Claims 1 to 14 are clearly distinguishable over this reference for the reasons that will be set forth.

The substrate of *Kinoshita* is nickel or another metal such as aluminum or stainless steel (column 4, lines 19-27) or it may be glass or sapphire or manganese that may be oxidized to form manganese oxide. On top of this is an intermediate layer of carbon that may be a carbon nanotube. As *Kinoshita* teaches, the nanotube of any chiral type may be used. Furthermore, the carbon may also be in the form of graphite, amorphous carbon or fullerenes. It is on top of this that the critical photocathode material, namely the alkali antimonide layer (5d) is deposited. The

resultant alkali antimonide film is depicted in Fig. 2 of *Kinoshita*. In column 5, *Kinoshita* teaches that the alkali antimonide layer is composed of particles of desired nominal dimensions of order 500 nm. While *Kinoshita* discloses (column 5, line 25) that "[t]he alkali metal containing layer 5d comprised of many particles can be formed by normal vapor phase epitaxy...", the layer so produced is in fact NOT an epitaxial single crystal as Kinoshita clearly shows in his Figure 2. Epitaxy as defined in the Merriam-Webster 9th New Collegiate Dictionary states, "epitaxy: the growth on a crystalline substrate of a crystalline substance that mimics the orientation of the substrate." This definition clearly does not apply to Kinoshita's structure as described in columns 4 and 5 of *Kinoshita*.

Independent Claim 1 as amended recites the following elements, the most pertinent to this discussion being presented in bold type for the convenience of the Examiner:

1. A photocathode manufacturing intermediary article comprising:

a crystal substrate suitable for single crystal growth thereon;

an active layer carried by the crystal substrate, the active layer including photoemissive alkali antimonide material **epitaxially grown as a single crystal on the substrate**; and,

the crystal substrate having a lattice constant approximately equal to the lattice constant of the active layer.

Since such a crystal substrate suitable for single crystal growth thereon of the Applicants' invention as claimed are not disclosed or suggested by *Kinoshita*, Applicants suggest that the claimed structure of the present invention is neither identical to nor disclosed by the *Kinoshita* device. Therefore, *Kinoshita* cannot anticipate the present claimed invention.

Moreover, the allegedly prior art devices lack the functional characteristics of the claimed structure of the method claim in the present application. Neither of the cited devices (*Kinoshita* nor *Kan*) have the substrate of the present invention.

The substrate of the present invention uses a single crystal spinel or equivalent material as specified in the subject patent application in paragraph 31. This single crystal substrate acts as a template for further single crystal growth of the alkali antimonide layer. The specific advantages of single crystal growth are specified in paragraph 45. Furthermore, the specific choice of spinel is a result of its lattice constant of 8.083 Å that is closely matched to alkali antimonide materials whose lattice constants range from 7.73 to 9.18 Å as indicated in claims 3 and 6 respectively.

Even if the *Kinshita* patent incidentally showed a similar arrangement of parts, if that arrangement is neither claimed nor designed to perform the function of the present invention, the *Kinoshita* patent can not act as an anticipation.

35 U.S.C. § 103 Grounds for Rejection

The Examiner rejected original Claims 1-10 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,670,752 by Kinoshita *et al.* (*Kinoshita*) in view of U.S. Patent No. 6,831,341 by Kan *et al.* (*Kan*) or the NPL document "Scanning electron diffraction studies on alkali antimonides, including S20." Applicants respectfully traverse these rejections for the reasons discussed below.

Applicants' invention is directed toward improving photoemissivity. It is important to note that while nickel or spinel or any number of other materials may be used as a substrate, a member of the spinel family is specifically claimed in Claims 2-3 and others because of its lattice

constant as mentioned above. Nickel has a lattice constant of 3.52 Å. This is more than 50% smaller than that of the alkali antimonides. Hence nickel is not suitable as a single crystal substrate.

Furthermore, there is no indication in the substrate (layer 5c) as taught by *Kinoshita* that it was intended to be single crystal.

Kan lists several substrates that are appropriate for ultraviolet radiation transmission. The materials taught by *Kan* are based only on their ability to transmit ultraviolet light and not on their lattice parameter. The material initially described in the text for the substrate is sapphire.

A member of the spinel family is explicitly claimed in Claims 2-3 and others on the basis that it is a well-matched substrate for the epitaxial growth of single crystal alkali antimonides. None of the other materials taught or suggested by *Kan* have the qualities of being both cubic and having a lattice parameter of 8.083 Å, which is appropriate for the alkali antimonides.

It is improper to use hindsight having read the Applicant's disclosure to "pick and choose" among isolated prior art references to disparage the claimed invention. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). Even where an invention is, as a whole, fully disclosed by a combination of prior art elements, such elements cannot be combined to defeat a patent as obvious unless the art teaches or suggests the desirability of making the combination. ASC Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). Thus, the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, U.S.P.Q.2d 1780 (Fed. Cir. 1992). Finally, it is the invention as a whole that is important. Focusing on the obviousness of substitutions and differences, instead of on the invention as a whole, is a legally improper way to simplify the

often difficult determination of obviousness. Gillette Co. v. S. C Johnson & Son, Inc., 919 F. 2d 720, 16 U.S.P.Q. 1923 (Fed. Cir. 1990).

Independent Claim 1, as amended, recites the following elements, the most pertinent to this discussion being presented in bold type for the convenience of the Examiner:

1. A photocathode manufacturing intermediary article comprising:

a crystal substrate suitable for single crystal growth thereon;

an active layer carried by the crystal substrate, the active layer including photoemissive alkali antimonide material **epitaxially grown as a single crystal on the substrate**; and,

the crystal substrate having a lattice constant approximately equal to the lattice constant of the active layer.

Applicants respectfully submit that the combination of *Kinoshita* with *Kan* or the NPL document does not disclose, teach, or suggest a crystal substrate suitable for single crystal growth there as recited by amended Claims 1 or 6. As conceded by the Examiner, *Kinoshita* "does not specifically teach the use of a spinel substrate." Office Action, page 3.

Alkali antimonides have been known as photoemitters since 1936. Since that time to the present, all production of these materials have been as polycrystalline photocathodes. The present patent application describes a product and method of producing an alkali antimonide single crystal photocathode that takes advantage of modern-day technology, namely molecular beam epitaxy (MBE). This has not been done in view of the cited references. By the presently disclosed growth technique, significant enhancement in the photoemission yield is expected. This is a result of the present method of growth having increased the purity, provided greater control over the entire process and thus yielded a greater carrier diffusion length and consequent

higher quantum efficiency of alkali antimonide photocathodes compared to that which is obtained currently being manufactured or taught.

In order to establish a prima facie case of obviousness, the prior art teachings must be sufficient to suggest making the substitution or modification necessary to make the claimed invention to one of ordinary skill in the art, In re Lalu, 747 F.2d 703, 705, 223 USPQ 1257, 1258 (Fed. Cir. 1984), in the absence of applicant's own disclosure. See also, In re Laskowski, 871 F.2d 115, 117, 10 USPQ2d 1397, 1398-99 (Fed. Cir. 1989) and Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985). The motivation to make a specific structure

> "is not abstract, but practical, and is always related to the properties or uses one skilled in the art would expect the [structure] to have, if made."

In re Gyurik, 596 F.2d 1012, 1018, 201 USPQ 552, 557 (CCPA 1979). See also Fromson v. Advance Offset Plate, Inc., 755 F.2d 1549, 1556, 225 USPQ 26, 31 (Fed. Cir. 1985)("Critical inquiry is whether 'there is something in the prior art as a whole to suggest the desirability, and, thus, the obviousness, of making the combination'").

There must have been a reason apparent at the time the invention was made to a person of ordinary skill in the art for applying the teachings at hand to effect the modification necessary to reach the claimed invention in the manner proposed or the use of the teaching as evidence of obviousness will entail prohibited hindsight. Graham v. John Deere of Kansas City, 383 U.S. 1, 148 USPQ 459 (1966), and In re Nomiya, 509 F.2d 566, 184 USPQ 607 (CCPA 1975).

Here there is lacking the requisite suggestion in these prior art disclosures that would have motivated the artisan to do what the Examiner has characterized as being an obvious combination.

Therefore, Claims 1 through 14 are not obvious in light of the cited art and Applicants respectfully submit that these rejections should now be withdrawn.

Further, Dependent Claims 2-5, and 6-14 that depend from independent Claims 1 or 6 are also not made obvious by *Kinoshita* in view of *Kan* or the NPL document because they include the limitations of either Claim 1 or 6 and add additional elements that further distinguish the art. Therefore, Applicant respectfully requests that Claims 1-14 be allowed.

New Claim

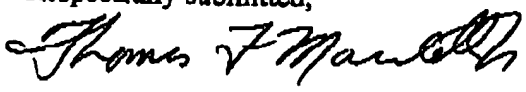
New Claims 11-14 are added to more fully claim the present invention. Claims 11 and 13 depends from Claim 1, and Claims 12 and 14 depends from Claim 6. Accordingly, Applicant respectfully submits that Claims 11-14 are patentable because each includes all the limitations of Claim 1 or 6 and adds additional elements that further distinguish the art.

Conclusion

Applicant has now made an earnest attempt to place this case in condition for allowance. In light of the amendments and remarks set forth above, Applicant respectfully requests reconsideration and allowance of Claims 1-14.

If there are matters which can be discussed by telephone to further the prosecution of this Application, Applicant invites the Examiner to call the attorney at the number listed below at the Examiner's convenience.

Respectfully submitted,



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ATTACHMENT A

LISTING OF CLAIMS WITH MARKINGS TO SHOW CHANGES MADE

Claim(s):

1. (Currently Amended) A photocathode manufacturing intermediary article comprising:

a crystal substrate suitable for single crystal growth thereon ~~layer~~; ~~and,~~

an active layer carried by the crystal substrate ~~layer~~, the active layer including photoemissive alkali antimonide material epitaxially grown as a single crystal on the substrate; and,

the crystal substrate having a lattice constant approximately equal to the lattice constant of the active layer.

2. (Currently Amended) The invention of claim 1 wherein the crystal substrate includes spinel.

3. (Original) The invention of claim 2 wherein the spinel has a lattice constant of 8.083Å.

4. (Original) The invention of claim 1 wherein the alkali antimonide material is in a cubic phase.

5. (Original) The invention of claim 1 wherein the alkali antimonide material has a lattice constant between 7.73 and 9.18 Å.

6. (Currently Amended) A method for making a photocathode manufacturing intermediary article comprising:

forming ~~an~~ a single crystal active layer carried by a crystal substrate suitable for single crystal growth thereon ~~layer~~, the active layer including photoemissive alkali antimonide material epitaxially grown on the crystal substrate; and,

the crystal substrate having a lattice constant approximately equal to the lattice constant of the active layer.

7. (Currently Amended) The method of claim 6 wherein the crystal substrate includes spinel.

8. (Original) The method of claim 7 wherein the spinel has a lattice constant of 8.083Å.

9. (Original) The method of claim 6 wherein the alkali antimonide material is in a cubic phase.

10. (Original) The method of claim 6 wherein the alkali antimonide material has a lattice constant between 7.73 and 9.18 Å.

11. (New) The invention of claim 1 wherein the substrate is transparent to light in a desired wavelength range.

12. (New) The method of claim 6 wherein the substrate is transparent to light in a desired wavelength range.

13. (New) The invention of claim 1 wherein the substrate is composed of a member from a family of materials including spinel.

14. (New) The method of claim 6 wherein the substrate is composed of a member from a family of materials including spinel.